Dr.Babasaheb Ambedkar Open University

DACA
DIPLOMA IN ADVANCE COST ACCOUNTING

Block

1

Basic of Cost Accounting

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પ્રકાશક

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અમદાવાદ-૩૮૨૪૮૧

UNIT : 1 : Cost Classification

Introduction

The primary purpose of accounting is to provide financial information relating to an economic/business activity. It is concerned with measuring, recording, and reporting financial information by the management to plan and control the activities of a business as well as by others who provide funds or who have various interests in the operations of an entity. Cost accounting and financial accounting both are done with their own benefits. Financial accounting is done by keeping in mind information needs of shareholders regarding yearly profits and losses and states of affairs where as cost accounting is done by keeping in mind the information needs of management about the product cost. The manager take important decisions on the basis of the data presented by the cost accountant. And so he has to present data which are suitable for the purpose for which they are wanted by the management. The person presenting such data should therefore know how costs are classified, which type of classification is useful in certain circumstances.

Structure of the Chapter:

1.1 Objectives:

By the end of this chapter the student will learn about

- Main objectives of cost accounting
- Different basis of cost classification

1.2 Meaning:

To understand the meaning of cost accounting it is necessary to understand the needs and benefits of cost accounting. Cost accounting is mainly beneficial in preparation of data for financial accounting. Financial accounting results in reports to external parties on the status of assets, liabilities and equity; results of operations; changes in owner's equity and changes in the sources and uses of funds for an accounting period. Cost data are/must be accumulated both for external financial accounting and internal management purposes. It accumulates, classifies and interprets information concerning the cost of materials, labour and other costs of manufacturing and marketing. Thus, it communicates financial information to management for planning, evaluating and controlling resources.

So, from the above benefits, we can say that, the accounting system that provides the information to measure product costs and performance, and control the operations of a firm is called cost accounting.

One of the primary concerns of financial accounting is the income determination. While calculating income, cost data are also used. Cost accounting provides an important input to financial accounting to the extent it provides cost data for determining income and financial position.

Thus, cost accounting is that part of accounting which identifies, defines, measures, reports and analyses the various elements of direct and indirect costs for inventory valuation and income determination, the needs of external users and management are fulfilled. It also provides management with an accurate, timely information for planning, controlling, and company operations.

1.3 Objectives :

The main objectives of cost accounting are :

1) Product costing
2) Planning, performance evaluation and control and
3) Decision making.

Product costing :

Different products are manufactured for the purpose of selling it, but to sell the product, it is required to determine the price of such product and for determining the selling price of the product it is necessary to know the cost of the product. Such cost can be determine by cost accounting. Ascertainment of cost is one of the primary objective of cost accounting. The determination of total product cost and cost per unit are important

for inventory valuation, product pricing and managerial decision making. Product costing covers the entire cycle of accumulating manufacturing and other cost and subsequently assigning them to work in progress, finished goods, and so on.

Planning and Control :

In a business various plans and budgets are prepared for the forth coming period after considering various elements of cost and which may be useful for the purpose of planning and control. The creation of useful cost data and information for planning and control by management is another important objective of cost accounting. The different plans/budgets are evaluated in relation to associated costs and benefits. The control technique compares the actual budgeted performances. The variances between budgets and actuals are analysed by causes and, in that light, corrective actions are taken.

Decision Making :

In a business, at different stages, various short term and long term decisions are taken and for taking such decisions, it is necessary to know the cost accounting records. Yet another objective of cost accounting is to provide information for both short and long term decisions. Decision making primarily involves choice out of available alternatives.

1.4 Cost Concepts :

Cost is defined as the 'value' of the sacrifice made to acquire goods/services, measured in monetary terms by the acquisition of assets or incurrence of liabilities at the time the benefits are acquired.

The cost data are classified in to various categories according to :

1) Element of a product
2) Relationship to production
3) Relationship to volume
4) Ability to trace
5) Department where incurred
6) Functional areas/activities performed
7) Period charged to income
8) Relationship to planning, controlling and decision making.

1.4.1 Element of a Product:

This classification provides management with information necessary for product pricing and income measurement. The cost elements of a product are:

i) Materials
ii) Direct labor
iii) Factory overheads.

Materials :

These are the principal substance used in production and are transformed into finished goods by the addition of direct labor and factory overhead. The cost of materials may be divided in to direct and indirect materials.

Direct Materials :

Direct materials means the material necessary for the production of the article or which may be directly needed in the production of the materials. It directly becomes the part of the product. All materials (a) that can be identified with the production of a finished item/product, (b) that can be easily traced to the product and (c) that represent a major material cost of producing that product are called direct materials. It is the material of which the article is made and which can be charged directly to specific cost unit. The timber used in making wooden furniture, the leather used in making shoes, cotton yarn used in manufacturing cotton cloth are examples of direct materials. So, within the definition of material all material will fall which may be specially purchased for a particular job, order or process or materials used as even packing materials. Moreover, certain expenses are also included in direct materials say, import duty, dock charges etc.

Indirect Materials :

These materials are not directly involved as a part of the product rather it is involved in an indirect manner with the production. These are included as a part of factory overhead. It consists of material which does not form part of the product but is is used for the purpose ancillary to production. It may include material required for the operating and maintaining plant and equipments known as consumable stores such as cotton waste, oil and grease, belts etc. or it may consists of stores used by service departments like canteen, powerhouse etc.

Labour :

It is the physical/mental effort expended in the production of a product. These are included as a part of factory overhead.

Direct labour :

Direct labour means the labour or the efforts which ultimately creates a product is known as direct labour. All labour directly involved in the production of a finished product (a) that can be easily traced to the product and (b) that represent a major labour cost of producing that product is known as direct labour. Wages paid to carpenter making furniture, wages paid to shoe maker making shoes or wages paid to weaver weaving the cloth are the examples of direct labour.,

Indirect labour :

The labour which is ancillary or supportive to the production of the product is known as indirect labour. It is the labour involved in the production of a product that is not considered direct labour. It is included as part of factory overhead. Wages and salaries paid to various persons who are not directly engaged in production e.g. Salary of works manager, supervisor, foreman, etc.

Factory overhead :

Overheads means the cost which is not directly attributable to the product. It accumulates indirect materials, indirect labour, and all other indirect manufacturing costs which cannot be directly identified with any specific product. They can be further classified as fixed, variable, and mixed which are explained later.

1.4.2 Relationship to Production:

Based on relationship to production, the two categories of costs are : (1) Prime Costs and (2) Conversion Costs.

Prime cost: These are the cost expenses primary needed for the production of the articles and which mainly involve direct materials and direct labour. These are directly related to production.

Conversion Costs: These are the cost needed to transform material into finished goods. These includes mainly direct labour and factory overhead.

1.4.3 Relationship to Volume:

Cost vary with changes in volume of production. Understanding their behaviour is vital in almost all aspects of product costing, performance evaluation and managerial decision making. On the basis of relationship to volume, costs are classifed as variable, fixed and mixed.

Variable Costs :

Variable costs means the cost which varies or changes with the changes in the level of output. These costs are those in which the total cost are assumed to change in direct proportion to changes in volume/output within the relevant range, while the unit cost remains constant. The variable costs are controlled by the departmental head responsible for incurring them.

Fixed cost :

Fixed cost means cost which remains fixed irrespective of number of units produced. Such cost are those in which the total fixed costs remain constant over a relevant range of volume/output, while the unit fixed cost varies with output. Beyond the relevant range of output, fixed costs will vary. The higher management controls the volume of production and is, therefore, responsible for fixed costs.

Mixed Costs :

These are the cost which contains the elements of both fixed cost and variable costs. These costs contain both fixed and variable characteristics over various relevant ranges of operation. These costs are also known as semi-variable costs. For example, most telephone service charges are made up of two elements : (i) A fixed charge for allowing to make/receive a call (ii) plus an additional variable charge for each call actually made.

1.4.4 Ability to Trace.

From the viewpoint of ability to trace it to specific jobs/departments/sales territories, and so on, cost may be

(i) direct and
(ii) indirect.

Direct cost : These are the cost which can be charged directly to the product. These are costs that are traceable conveniently and wholly by management to specific items/areas. The examples of such costs are direct material and direct labour for a specific product.

Indirect costs: These are the cost which can be charged in an indirect manner to the product. These are common to many items and cannot be traced to any one item/area. These are usually charged to items/areas on the basis of allocation techniques. For example, indirect manufacturing costs are allocated as a part of factory overhead.

1.4.5 Department Where Incurred:

Cost can be classified even on the basis of the department wise. A department wise costing is helpful to management in controlling overhead cost and in income measurement. A department is a major functional division of a business. A manufacturing company has typically two departments (i) production and (ii) service.

Production department : This is the department where the manufacturing activity is carried on. These directly contribute to production of goods. These includes departments in which conversion/production processes take place, including manual/machine operation directly performed on the goods manufactured.

Service department : In these type of department, activities ancillary to the main activity is carried on. These are not directly related to production. These provide services for other departments. Their cost are usually allocated to production departments benefiting from the services. The examples of service departments are payroll, factory office, personnel, cafeteria, and security of a factory.

1.4.6 Functional Areas :

Sometimes costs are classified even on the basis of different functions. Function wise, costs are accumulated on the basis of activity performed. In case of a manufacturing company, cost classification by function relate to manufacturing, marketing, administrative, and financing.

Manufacturing cost : Manufacturing activity is related with the production of the goods. These are related to production of items and constists of direct materials, direct labour, and factory overhead costs.

Marketing Cost : These activity is related with the creating market for the produced goods. These are incurred in promoting products/service.

Administrative Costs : These activities are concerned with the making the all the system operated. These are incurred in directing, controlling, and operating a company. Such costs include salaries to management and workers.

Financing costs : This activity is concerned with the bringing the finance in the business as per necessity and using it for best possible alternative. These relate to acquiring funds for the operations of the company. These include interest on loans and cost of credit to customers.

1.4.7 Period Charged to Income :

Costs can also be classfied even on the basis of time period. Here, the main classification is in between period as well as on the products. Costs can also be classified on the basis of when they are charged to income/revenues. Such a classification helps management in (i) income measurement (ii) preparation of financial statements and (iii) matching expenses to income property in appropriate period. Based on period charged to income, cost are classified into product and period costs.

Product costs : Product cost may also be known as variable cost which mainly changes with the changes in the number of units produced. These are directly/indirectly identifiable with the product and include direct materials, direct labour, and factory overhead. Upon completion of the product, they are inventoried as they provide benefit/income only after sale. The product costs are recorded as expense after sale of the product, known as cost of goods sold and are matched against income/revenue for the period in which the products are sold.

Period costs : Here, under this head, goods are not charged to the product, rather it is charged on the basis of period, which mainly includes fixed costs. These are not at all related to production. The examples of such costs are accountants salary, depreciation cn a car, and interest on bonds. Period costs are not inventoried but are charged to revenue immediately as there is no relationship between cost and revenue.

1.4.8 Relationship to Decision Making :

The costs related to decision-making are as follows.

Relevant and Irrelevant costs :

Relevant cost may be known as the cost which is necessary for the purpose of decissing making. Relevant costs are expect future costs that differ among alternative course of action. They may be eliminated if some activity is changed/dropped.

Irrelevant costs are such cost which is not useful for decision making or which may not be considered in decision making. Irrelevant costs are not affected by management action. An example of irrelevant cost is sunk cost that is irrevocable such as depreciation. When confronted with a choice, they are not relevant and should not be considered for decision-making analysis.

However, relevancy is not an attribute of any particular cost. An identical cost may be relevant in one situation but irrelevant in another. Which cost are relevant and

which are irrelevant would depend upon the specific facts of a given situation.

Differential costs : Differential cost indicates difference between the costs of two alternative course of actions. The difference between the costs associated with alternative course of action on an item by item basis is differential cost. If the differential cost is increasing, it is called incremental cost; it is known as decremental cost when the differential cost is decreasing.

The differential cost is the key to a specific decision. Frequently, incremental costs equal variable costs. But in case of production beyond the relevant range, fixed cost would also increase along with variable cost. For decision-making in such special situation, incremental analysis should consider the differential both in fixed cost and variable cost.

Opportunity costs :

It is the cost of opportunity lost. When a decision to pursue one alternative is made, the benefits of other options are foregone. Benefits lost from rejecting the next best alternative are the opportunity costs of the chosen options.

Although opportunity costs are not shown in accounting records as they are not actually incurred, they are relevant costs for decision-making and must be considered in evaluating a proposed alternative.

Shut-down costs :

These are the cost associated with the shut down of the operations. Sometimes it is even needed to shut down the operation for temporary period mainly in case of seasonal business. These are those fixed costs which would be incurred even if there was no production. Examples of such costs are rent, storage costs, insurance, salary and so on. In a seasonal industry, management has to decide whether to suspend operation or to remain open during the 'off-season'. In the short run, it is advantageous to remain open as long as sufficient sales can be generated to cover variable cost and contribute to the recovery of fixed costs.

1.5 Exercise

1. Explain the direct cost and indirect cost?
2. Write a note about cost classification on the basis of functions?
3. Explain Opportunity cost?
4. What is meant by Relevant and irrelevant cost?
5. Explain the concept of controllable and uncontrollable cost?
6. Explain the concept of discrenatory fixed cost and committed fixed cost?
7. What is meant by period wise and product wise classification of different cost?

Unit : 2 : Materials

Introduction:

For production of a particular unit mainly three elements are needed. Raw material, labour and overheads. Out of which raw materials constitute an essential element of production. After raw materials are purchased and temporarily placed in store, they are processed/transformed into finished goods. Expenses for bringing and handling of materials demands due care as it includes investment of big amounts. During this chapter, we will discuss about the various methods for reducing expenses related to materials.

Structure of the chapter:

2.1 Objectives:

By the end of this chapter, the student will learn about

- Procedure for material handling in an organization
- Perpetual and periodic inventory system
- ABC system of inventory handling
- EOQ method
- Trial and Error method

2.2 Materials And Its Control

The ultimate intension of this chapter is to reduce material cost. If the material cost is not reduced it will increase overall production cost. So, here we shall discuss about the various methods for material controls. Right control over materials are necessary

not only to guard against theft, but also to minimise waste and misuse from causes such as excessive inventories, overissue, deterioration, spoilage, and obsolescence. So, inventory control can help in many respect in the cost reductions.

Now, we shall discuss about the various system for reducing overall inventory cost:

2.4 Periodic Inventory System

Here, the counting of materials along with the cost of it, is carried out at periodic intervals so that the record of the material can be kept up to date. A physical count is made of the materials on hand at the end of the period to arrive at the closing/ending materials inventory.

The entire book inventory is verified at a given date by an actual count of materials on hand. This physical inventory is usually taken near the end of the accounting year/period. This method provides for the recording of the purchases on a daily basis but does not provide for a continuous inventory-taking rather it provides for the periodic inventory checking. Neither does it provide for a daily/continous computation of cost of goods sold. At the end of each accounting year, a physical count is made of the quantity of goods on hand, and the value of the inventory is determined by using an appropriate pricing method and attaching costs to units counted so that the record can be updated. It is assumed that goods not on hand at the end of the period have been sold.

2.5 Perpetual Inventory System

A perpetual inventory system is one in which the inventory quantities and values for all purchases and issues are recorded directly in the inventory system as they occur. Perpetual inventory system balances are verified by means of periodic physical counts. A revolving physical count, where segments of inventories are counted at different times, may be used, provided all inventories are counted at least every other fiscal year.

Here, the counting of the material and its physical chech is continouly carried on. The effect is that the cost of materials issued is charged to production at the time when the materials are issued and the balance in the Material Inventory Account shows the cost of materials still available for use/issue. Therefore, both the cost of materials issued and the ending materials inventory can be directly ascertained after each transaction.

The perpetual inventory system is superior to the periodic inventory system. It provides better inventory/materials control and more information than the periodic inventory system.

Inventory Control Techniques

The important techniques covered here are: (i) ABC analysis, (ii) Economic order quantity (EOQ), (iii) Reorder-point and (iv) Safety stock.

2.6 The ABC-analysis

When planning the guidance- and control systems of the inventories containing a large amount of items the items should be first divided into different differently controlled and guided categories. The method to be used is the ABC-analysis. It is based on the 20-80 -principle, which is also called as the Pareto principle.

20% of the amount of the materials is about 80% of the annual demand

20% and 80% are average values and the distribution can as well be 65-35% or 90-10%. With this principle we try to realise the following object:

Aim the development to the part

which has the biggest value/significance.

1. Guidance measures:

A - items The strictest possible control including complete reports, regular observing of the situation, frame contracts of the supplying, continuing deliveries, and accurate anticipating of the situation to minimise the order lead-time.

B - items Normal guidance. Good and regular reporting.

C - Items The simplest possible guidance including frequent physical inventorying. The simplest possible supply routine. Adequate buffer inventories and order batches to avoid stock-outs. Consider if you can give up C - items.

D - items Get rid of these items.

2. The material bookkeeping

A - items Bookkeeping must be as precise as possible, complete and done with short intervals. Accurate control of surplus and waste material.

B - items An ordinary bookkeeping.

C - items No bookkeeping or the simplest possible.

D - items Must be removed out of the bookkeeping

3. The ordering system

A - items The most accurate anticipation of the future needs. Precisely determined order batch sizes and order time points. Accurate delivery time control.

B - items Anticipation of the needs, optimal order batch sizes, delivery time control, but fewer control periods than with A - items.

C - items No optimal order batch sizes, no order points. The annual demand can be ordered at once. Think, if the C - items are needed at all.

D - items Never order or buy D-items. Get rid of the remaining ones.

2.7 Economic Order Quantity Model (Eoq): Order Quantity Problem

This is the best method used for the purpose of saving or reducing the cost of inventory. Inventory management should be such that the order of the inventory should be of such quantity so that the total cost involved in the ordeing and the management of the inventory is minimized. In other words, while purchasing raw materials or finished goods, the questions to be answered are: How much inventory should be bought in one lot under one order on each replenishment so that the total inventory cost of purchasing and storing is minimized? Such inventory problems are called order quantity problems.

At the time of making the order normally three mattes shall be considered purchase cost, order cost and carrying cost. Buying in large quantities implies higher average inventory level, which will assure: (i) Smooth production/sale operations, and (ii) Lower ordering or set-up costs. But it will involve higher carrying costs. On the other hand, small orders would reduce the carrying costs of inventory by reducing the average inventory level but the ordering costs would increase, as also there is a likely interruption in operations due to stock-outs. A firm should place neither too large nor too small orders. The optimum level of inventory is popularly referred to as the Economic Order Quantity (EOQ). The economic order quantity may be defined as. that level of inventory order that minimises the total cost associated with inventory management. Stated with reference to the cost perspectives, EOQ refers to the level of inventory at which the total cost of inventory comprising acquisition/ordering/set-up costs and carrying costs is the minimum.

Approaches The EOQ model can be illustrated: (i) By long/analytical approach or trial and error approach, and (ii) By the shortcut or simple mathematical approach.

2.8 Trial and Error Approach

The method is not so scientific as it is using various random trials. The trial and error or long analytical approach to determine EOQ uses different permutations and combinations of. lots of inventory purchases so as to find out the least ordering and carrying cost combination. In other words, according to this approach, the carrying and acquisition costs for different sizes of orders to purchase inventories are computed, and the order-size with the lowest total cost (ordering plus carrying) of inventory is the economic order quantity.

Mathematical (Short-cut) Approach The economic order quantity can, using a short-cut method, be calculated by the following equation:

$$EOQ = \sqrt{\frac{2AB}{C}}$$

Where A = Usage unit for the inventory planning period (total inventory requirement in units)
B = Buying cost per order*
C = Carrying cost per unit

2.9 Reorder Point:

The reorder point is stated in terms of the level of inventory at which an order should be placed for replenishing the current stock of inventory. In other words, reorder point may be defined as that level of inventory when a fresh order should be placed with the suppliers for procuring additional inventory equal to the economic order quantity.

The formula for the reorder point is:

The reorder point = Lead time in days x Average daily usage of inventory

The term, "lead time" refers to the time normally taken in receiving the delivery of inventory after placing orders with the suppliers.

Safety Stock

Safety stock means the minimum stock desired in the inventory. Another way of saying the same thing is that the demand for inventory cannot be anticipated with certainty, that is, the likely demand for inventory is uncertain. The effect of increased usage and/or slower delivery would be shortage of inventory. That is, the firm would disrupt production schedule and alienate the customers. The firm would, therefore, be well advised to keep a sufficient safety margin by having additional inventory to guard against stock-out situations. Such stocks are called safety stocks.

Maximum Level:

Formaula for maximum level:

Re-order Level-(minimum consumption*minimum delivery time)+Re-order Quantity

Minimum Level:

Formula for minimum Level:

Re-order Level- (Average Consumption*Average delivery time)

2.10 Practical:

1. Tanushri Ltd. has seven different items' in its inventory. The average number of each of these items held, along with their unit-costs, is listed below.

Items number	*Average number of units in inventory*	*Average cost per unit*
1	20,000	Rs 60.80
2	10,000	102.40
3	32,000	11.00
4	28,000	10.28
5	60,000	3.40
6	30,000	3.00
7	20,000	1.30

The company wishes to introduce an A B C inventory system. Suggest a breakdown of the items into A, B and C classifications.

Solution

The ABC analysis is presented in following table

Table showing *ABC Analysis*

Item (1)	*Units (2)*	*Per cent of Total (3)*		*Unit Cost (4)*	*Total Cost (5)*	*Per cent of Total (6)*	
1	20,000	10		Rs 0.80	Rs 12,16,000	Rs 38.00	
2	10,000	5	15	102.40	10,24,000	32.00	70
3	32,000	16	30	11.00	3,52,000	11.00	20
4	28,000	14		10.28	2,88,000	9.00	
5	60,000	30		3.40	2,04,000	6.38	
6	30,000	15	55	3.00	90,000	2.80	
7	20,000	10		1.30	26,000	0.82	10
Total	2,00,000	100	100		32,00,000	100.00	100

2. Smita Ltd.'s inventory planning period is one year. Its inventory requirement for this period is 1,600 units. Assume that its acquisition costs are Rs 50 per order. The carrying costs are expected to be Re 1 per unit per year for an item. The firm can procure inventories in various lots as follows: (i) 1,600 units, (ii) 800 units, (iii) 400 units, (iv) 200 units, and (v) 100 units. Which of these order quantities is the economic order quantity?

Solution

The calculations of the inventory costs for the data in four different order quantities are shown in table below.

Table showing *Inventory Cost for Different Order Quantities*

1. Size of order (units)	1,600	800	400	200	100
2. Number of orders	1	2	4	8	16
3. Cost per order	Rs 50	Rs 50	RS 50	Rs 50	Rs 50
4. Total ordering cost (2 × 3)	50	100	200	400	800
5. Carrying cost per unit	1	1	1	1	1
6. Average inventory (units)	800	400	200	100	50
7. Total carrying cost (5 × 6)	800	400	200	100	50
8. Total cost (4+ 7)	850	500	400	500	850

Working Notes

(i) Number of orders = Total inventory requirement/ Order size

(ii) Average inventory = Order size/2

It can be seen from Table 3.3 that the carrying and ordering costs taken together are the lowest for the order size of 400 units. This, therefore, is the economic order quantity.

3. The following details are available in respect of Tarzan Ltd.:

1. Inventory requirement per year, 6,000 units
2. Cost per unit (other than carrying and ordering costs), Rs 5
3. Carrying costs per item for one year, Rs 1
4. Cost of placing each order, Rs 60
5. Alternative order size (units): 6,000, 3,000, 2,000, 1,200, 1,000, 600 and 200.

Determine the EOQ.

Solution

The EOQ is determined in following table.

Table showing *Determination of Economic Order Quantity*

1. Cost of items purchased each year	Rs 30,000	Rs 30,000	Rs 30,000	Rs 30,000	Rs 30,000	Rs 30,000	Rs 30,000
2. Order size (units)	6,000	3,000	2,000	1,200	1000	600	200
3. Number, of orders	1	2	3	5	5	10	30
4. Average inventory (units)	3,000	1,500	1,000	600	500	300	100
5. Total carrying cost	3,000	1,500	1,000	600	500	300	100
6. Total ordering costs	60	120	180	300	360	600	1,800
7. Total cost (carrying plus ordering cost)	3,060	1,620	1,180	900	860	900	1,900

Clearly, the EOQ is 1,000 units.

4. Using the facts in Example given above, find out the EOQ by applying the short-cut mathematical approach.

Solution

$$EOQ = \sqrt{\frac{2 \times 1{,}600 \times 50}{1}} = 400 \; Units$$

5. Ram Ltd uses three types of materials *A*, *B* and *C* for production of '*X*', the product. The relevant monthly data, for the components are as given below :

	A	*B*	*C*
Normal usage (In units)	200	150	180
Minimum usage (In units)	100	100	90
Maximum usage (In units)	300	250	270
Re- order Quantity (In units)	750	900	720
Re-order Period (In months)	2 to 3	3 to 4	2 to 3

Calculate for each component :

(a) Re-order Level

(b) Minimum Level

(c) Maximum Level

(d) Average Stock Level

Solution

(a) Re-order Level=Maximum Period	Re-order × Maximum	Consumption
A	B	C
3 ×300	4 × 250	3 × 270
=900 units	= 1 ,000 units	= 810 units

(b) Minimum Level= Re-order level- (Normal × Average) usage* Delivery Time)

= *A*	*B*	C
900-(200 × ½)	1000- (150 ×3 ½)	810— (180 × 2 ½)
900-500	1000—525	810 -450

400 units 475 units 360 units

(c) Maximum Level=Re-order Level—(Min. +Re-order Level Consumption × Min. Re-order period)

A	*B*	*C*
=900-(100 × 2)+750	1,000-(100 × 3)+900	810- (90×2)+720
=900-200=750	1,000-300+900	810-1804+720
= 1,450 units	1,600 units	1,350 units

(d) Average stock Level = Minimum Level + Maximum Level /2

A	*B*	*C*
(400+-1450)/2	(475+1600)/2	(360+350)/2
=925 units	=1,038 units	=855 units

6. Dev Enterprises manufactures a special product "Q". The following particulars were collected for the year 1996:

(a) Monthly demand of Q 1,000 units.

(b) Cost of placing an order Rs. 100.

(c) Annual carrying cost per unit Rs. 15.

(d). Normal usage 50 units per week.

(e) Minimum usage 25 units per week.

(f) Maximum usage 75 units per week.

(g) Re-order period 4 to 6 weeks.

Compute from the above

(1) Re-order Quantity

(2) Re-order Level.

(3) Minimum Level.

(4) Maximum Level.

(5) Average Stock Level.

Solution :

1. Re-order quantity (of units used)

$$=\sqrt{\frac{2U \times P}{S}}$$

Where

U= Annual demand of input units

P=Cost of placing an order

S= Annual carrying cost per unit

= 186 units (approx)

2. Re-order Level = Maximum re-order period × Maximum usage.
=6 weeks ×75 units
=450 units.

3. Minimum Level = Re-order Level—(.Normal usage × Average Reorder period)
=450 units—(50 units × 5 weeks.)
=450 units—250 units
=200 units.

4. Maximum Level=Re-order level + Re-order quantity—(Minimum usage × Minimum Order period.)

=450 units+186 units—(25 units × 4 weeks.) =536 units.

5. Average Stock Level

= $^1/_2$ (Minimum Stock Level-f Maximum Stock Level)

= $^1/_2$ (200 units+ 536 units)

= 368 units.

Working Notes :

U=Annual demand of Input units for 12,000 units of 'Q'.

=52 weeks × Normal usage of input units per week.

=52 weeks × 50 units of input per week. =2,600 units.

7.Following information relating to a type of raw material is available in respect of Bharat Ltd.:

Annual Demand	2,400 units
Unit Price	Rs. 2.40

Ordering cost per order	Rs. 4.00
Storage Cost	2% per annum
Interest Rate	10% per annum
Lead Time	Half- month.

Calculate Economic Order Quantity, and total annual inventory cost in respect of the particularraw material.

Solution.

$$EOQ = \sqrt{\frac{2U \times P}{S}}$$

where U== annual consumption

P=cost per order

S=inventory carrying cost per unit *(i.e.* storage and interest)

$$EOQ = \sqrt{\frac{2 \times 2{,}400 \text{ units} \times \text{Rs. } 4}{2{\cdot}4 \times \left(\frac{2+10}{100}\right)}}$$

$$= \sqrt{\frac{4{,}800 \times 4}{2{\cdot}40 \times \frac{12}{100}}}$$

$$= \sqrt{\frac{19{,}200}{0{\cdot}288}} = 258 \text{ units.}$$

Computation of Total Annual Inventory Cost :

Cost of 2,400 units at Rs. 2.40	Rs. 5,760.00
Ordering cost : 2,400/258=9.3 orders or say 10 orders at Rs, 4	Rs. 40.00
Carrying cost of average inventory	
258 × ½ ×2.40 × 12% = 258 / 2 × 0.288	Rs. 37.15
	Rs. 5,837.15

8. From the following information about consumption of coal in a foundry, determine the economic ordering quantity for Shilpa Ltd.

Consumption during the year 10,000 kgs.
Carrying cost of inventory Re. 0.40.
Ordering cost Rs. 80.
Price per kg. of coal Rs 5

SOLUTION:

Economic Order Quantity $= \sqrt{\frac{2AO}{C}}$

$= \sqrt{\frac{2 \times 10,000 \times 80}{0.40}}$

$= \sqrt{\frac{16,00,000}{0.4}}$

$= \sqrt{40,00,000}$

$\therefore$ EOQ (in units) = 2,000 kgs.

And, EOQ (in Rs.), = 2,000 × Rs 5 = Rs. 8,000

9. Annual consumption of same item of material is 10,000 units. Fine the economic ordering quantity from the following available data for shilpa Ltd.

Price per unit = Rs 5 Cost of placing an order = Rs. 8
Annual rate of interest = 5%
Cost- of 'carrying inventory per annum = Re. 0.30

Solution:

$EOQ = \sqrt{\frac{2AO}{PI + C}}$

$= \sqrt{\frac{16,000}{(0.25) + 0.30}}$

$= \sqrt{29,091}$

= 171 units

Where

A = Quantity Consumed = 10,000 units

O= Cost of placing an order = Rs. 8

P = Price per unit = Rs. 5

I = Rate of interest = 5%

C = Carrying Cost = Rs. 0.30

10. In Devdas Ltd., the annual consumption of raw material is 6,000 units and its present Ordering Quantity is 1500 units. Its ordering cost per order is Rs. 150 and its carrying cost per unit is Rs. 10. If the firm purchase 2,000 units, it will get quantity discount of 1/2 per cent. The price of material is Rs. 100 per unit. Say whether the firm should decide to get the benefit of quantity discount.

Solution:

(A) Total Inventory Cost as per present purchasing quantity:

Particulars	Rs.	
(i)	Cost of Raw-materials: (6,000 units × Rs. 100)	6,00,000
(ii)	Ordering Cost: No. of orders = 6,000 ÷ 1,500 = 4 orders $\therefore$ Ordering cost = Rs. 150 × 4 =	600

(iii) Carrying cost:

Average inventory = 1,500 ÷ 2 = 750 units × Rs. 10 = 7,500

∴Total Cost 6,08,100

(B) Total Inventory Cost if discount offer is accepted:

Particulars		**Rs.**
(i)	Cost of Raw materials (6,000 units × Rs. 99.50) (Price per unit = Rs. 100 - 1/2% discount = Rs. 99.50)	5,97,000
(ii)	Ordering Cost: No. of orders = 6,000 ÷ 2000 = 3 orders × Rs. 150 =	450
(iii)	Carrying cost: Average inventory = 2000 ÷ 2 = 1,000 units × Rs. 10 =	10,000
	∴Total cost	6,07,450

Thus, there is a saving of Rs. 650 (6,08,100 - 6,07,450) by accepting the quantity discount offer; the firm should get the benefit of discount by purchasing in the quantity of 2000 units.

11. The annual requirement of a certain raw material of Dhirubhai Ltd. is 60,000 units. Its ordering cost is Rs 160 while its carrying cost is Re. 0.10 per unit. It can make purchase either in lot of 60,000 units, 30,000 units, 15,000 sunits, 10,000 units and 5,000 units.

Determine the economic ordering quantity by means of trial and error method.

Solution

1. Purchases (units)	60,000	30,000	15,000	10,000	5,000
2. Number of orders	1	2	4	6	12
3. Ordering Cost	Rs. 160	Rs. 160.	Rs. 160	Rs. 160	Rs. 160
4. Total Cost for placing orders	Rs.160	Rs. 320	Rs. 640	Rs. 960	Rs1,920
5. Carrying Cost per unit	0.10	0.10	0.10	0.10	0.10
6. Average Inventory	30,000	15,000	7,500	5.000	2,500
7. Total Carrying Cost	Rs. 3.000	Rs. 1500	Rs. 750	Rs. 500	Rs. 250
8. Total Cost (Carrying costs + Ordering Cost)	Rs. 3,160	Rs. 1,820	Rs1,390	Rs. 1,460	Rs.2.170

From the above details, it is seen that the total cost is minimum when purchases are made in lots of 7,500 units. Hence, EOQ is 7,500 units. Let us calculate it by using formula method.

$$EOQ = \sqrt{\frac{2AO}{C}}$$

$$= \sqrt{\frac{2X60{,}000XRs.160}{Rs.0.10}}$$

$$= \quad \sqrt{192000000} \quad = \quad 13{,}856 \text{ units.}$$

By formula method, we get 13,856 units, but as purchases are made in lots of 15,000 units, it would be the economic ordering quantity.

12. Following information is available in respect of consumption of material Vanita Ltd.

Average Consumption	200 units per day
Minimum Consumption	120 units per day
Maximum Consumption	260 units per day
Ordering Quantity	10,000 units
Re-order Period (Time required to obtain fresh supplies)	25 to 30 days

Determine the Ordering level, Maximum level, Miximum level and Safety level.

Solution

(1) **Ordering Level** = Maximum Consumption × Maximum Delivery Time
= 260-units × 30 days
= 7,800 units

(2) **Maximum Level** = Ordering Level - (Minimum Consumption of Minimum Delivery Time) + Ordering Quantity
= 7,800 units - (120 units × 25 days) + 10,000 units
= 7,800-3,000 + 10,000
= 14,800 units

(3) **Minimum Level** = Ordering Level - (Average Consumption × Average Delivery Time)
= 7,800 units - (200x25+30/2)
= 7,800 units - 200 × 27.5
= 7,800- 5,500
= 2,300 units

(4) **Safety Level:** Maximum Consumption × (Maximum Delivery Time- Average Delivery Time)
= 260 × (30 days - 7.5 days)
= 260× 2.5
= 650 units.

13. The following items of materials are used by Neelam Ltd.

Item	Number or Units	Price per unit Rs.
1	2,000	55
2	1,000	100
3.	3,500	12
4	2,500	7.20

5	5,000	2.72
6	3,200	3.20
7	2,800	2.20

From the above information, prepare ABC analysis of Inventory.

Solution:

Item	Number of Units	Percentage		Price Per Unit	Total Price Rs.	Percentage Rs.	
1	2,000	10	15%	55	1,10,000	36.67	70%
2	1,000	5	(A)	100	1,00,000	33.33	
3	3,500	17.5	30%	12	42,000	14.00	20%
4	2,500	12.5	(B)	7.20	18,000	6.00	
5	5,000.	25	55%	2.72	13,600	4.53	
6	3,200	16	(C)	3.20	10,240	3.41	10%
7	2,800	14		2.20	6,160	2.06	
	20,000	100			3,00,000	100	

The above calculations show that

Items (1) + (2) constitute 15% of total items but its value is as high -as 70%. Hence, they will be placed in group A.
Items (3) + (4) constitute 30% of total items, and their value is 20%^ and so they will be placed in group B.
Items (5) + (6) + (7) constitute 55% of total items and its value is only 10%. Hence they will be placed in group (C).

2.11 Practical Exercise:

1. In Chirag Ltd., the annual consumption of material being used is 2,000 units and price per unit is Rs. 15. Ordering cost is Rs.17, Carrying cost is Re. 1 and rate of interest is 10%. Determine the Economic Ordering Quantity.
2. From, the following information, find out Maximum level and Minimum-level for Hiren Ltd.

   Minimum Consumption = 200 units per week
   Maximum Consumption = 800 units per week
   Ordering time = 3 to 5 weeks
   Economic Order Quantity = 3,600 units.

3. The annual requirement of a material in Mita Ltd. is 6,000 units. The ordering costs come to Rs. 150 and carrying cost is Rs. 1.20 per unit. The firm can place orders for following quantities. (1) 3,000 units (2) 1,500 units (3) 600 units (4) 300 units (5) 150 units (6) 75 units. Calculate the EOQ by trial and error method from the above data.

4. From the following figures, calculate economic order quantity and number of orders to be placed in each year.

Annual consumption of material 5,000 kg.

Cost per unit Rs. 2

Cost of buying per order Rs. 5

Storage and carrying cost 8% on average inventory.

5. Two components *X* and *Y* are used as follows in Hiren Ltd.:

Normal usage : 600 units per week each.

Maximum usage : 900 units per week each.

Minimum usage : 300 units per week each.

Reorder quantity :

X:4,800 units Y :7,200 units.

Reorder period :

X: 4 to 6 weeks *Y:3 2* to 5 weeks.

Calculate for each component: *(a)* Re-order level, *(b)* Minimum level, *(c)* Maximum level, *(d)* Average stock level.

6. Nikita Ltd. purchases 2,000 units of a particular item per year at a unit cost of Rs. 20, the ordering cost per order is-Rs. 50 and the inventory carrying cost is 25%. Find the optimal order quantity and the minimum total cost including purchase cost.

If a 4% discount is offered, by the supplier for purchases in lots of 4,000 or more, should the publishing house accept the order ?

7. A manufacturer uses 300 units of a component every month and he buys. them entirely from an outside supplier. The order placing and receiving cost is Rs.-100 and annual carrying cost is **Rs.** 13. From this set of data, calculate the Economic Order Quantity.

8. The daily demand for an electronic machine is approximately 25 items. Every time an order is placed, a fixed cost of Rs. 25 is incurred. The daily holding cost per item inventory is Re. 0.45% The lead time is 16 days, determine the economic and reorder point.

9. A manufacturer has to supply his customer 600 units of his product per year. Storage is not allowed and the inventory carrying cost amount to Re. 0.70 per unit per year. The set-up cost per run is Rs. 80. Find :

(i) The Economic order quantity. *(ii)* The minimum average yearly cost, (iii) The optimum number of orders per year, (iv) The optimum period of supply per

optimum order.

10. Following information relating to a type of raw material is available :

Annual Demand	2,400 units
Unit Price	Rs. 2.40
Ordering cost per order	Rs. 4.00
Storage cost	3% per annum
Interest rate	10% per annum
Lead time	Half month

Calculate Economic Order quantity, and total annual inventory cost in respect of the particular raw material.

11. A wholesaler supplies 30 stuffed dolls each week day to various shops. Dolls are purchased from the manufacturer in lots of 120 each of Rs. 1200 per lot. Every order incurs a handling charge of Rs. 60 plus a freight charge of Rs. 2.50 per lot. Multiple and fractional lots also can-be ordered and all orders are filled the next day. The incremental cost is Re. 0.60 per year to store a doll in inventory. The wholesaler finances inventory investment by paying its holding company 3% monthly for borrowed funds.

(i) - How much dolls should be ordered at a time in order to minimise the total annual inventory cost ? Assume that there are 250 week days in a year. How frequently should he order ?

2.12 Exercise

1. Explain the basic procedure for material handling in an organization?
2. Explain periodic inventory system and perpetual inventory system?
3. Explain ABC method of inventory handling?
4. Explain the concept of EOQ?
5. Explain the concept of trial and error?

Unit : 3 : Labour

Introducting

For the purpose of manufacturing, three things are required, material, labour and overheads. Manufacturing is a process by which raw materials are converted into finished products. The two elements of conversion costs are direct labour, and factory overheads. This chapter explores the costing and control of labour.

The compensation paid to the employees engaged in production related activities represents factory labour cost. The principal labour cost is *wages* paid to production workers made on hourly, daily, monthly, or price work basis. Included in labour costs are not only the regular earnings of the workers but also supplementary costs such as pensions, vocation and holiday pays, insurance benefits and other fringe benefit costs. Labour costs may be direct or indirect.

Structure of the chapter:

3.7 Exercise

3.1 Objectives:

By the end of this chapter, the student will learn about

- What is labour cost
- Different methods of wage determination
- Different methods for wage incentives
- Labour turnover

3.2 Accounting for Labour

Accounting of labour is one of the major activities in manufacturing units, specially in labour oriented units.

Minimum Guaranteed Wage and Incentive Plans

Workers are working for getting reward in the form of wages. Here, under this system of wage payment, certain amount of wage payment is given irrespective of no. of units produced. Under the piecework rate system of wage payment, employees earnings is equal to the number of units produced multiplied by the piecework rate. Several manufacturing organisations have a system of wage payment under which employees are paid a minimum guaranteed wage with a stipulation that they can earn more if they produce more. Employees who produce more than a specified number of units (piecework) receive a bonus.

The incentive (bonus) plans vary in format and application. They fall into two categories: (1) Differential piece rates schemes and (2) Premium bonus plans.

3.3 Differential Piece Rates Schemes

Included in this category are (i) Taylor Differential Piece Rate System, (ii) Merrick Differential Piece Rate System, and (iii) Gantt Task and Bonus Plan.

3.3.1 Taylors Differential Piece Rate System

Most people who are interested in management history have heard of Frederick W. Taylor's paper, "A Piece Rate System." This is the paper he presented to The American Society of Mechanical Engineers (ASME) that described his approach for motivation and efficiency in the workplace. Delivered during the June 25-28, 1895 Detroit meeting, it provided an early version of what Taylor would eventually call scientific management. While many management history buffs are familiar with Taylor's Scheme.

3.3.2 Merrick Differential Piece Rate System

Also called Merrick multiple price rate, incentive wage plan that establishes three different piece rates on the basis of performance-one for beginners, one for average workers, and one for superior workers. This is a modification of/improvement over the Taylor Differential Piece Rate System. It uses three piece rates. Normal piece rates are paid when output is upto 83 per cent of the standard output; 110 per cent of normal piece rates are paid for output between 83 - 100 per cent; and 120 per cent is paid if the output exceeds 100 per cent. While it rewards efficient workers, it does not penalise less efficient workers as minimum upto 83 per cent could possibly be achievable by all workers.

3.3.3 Gantt Task and Bonus Plan

This system is a mixture of a guaranteed time rate with a bonus and piece rate plan using the differential principle. When output is below standard/high task (efficiency below 100 per cent), time rate is guaranteed. In case of output at standard level (100 per cent efficiency), bonus @ 20 per cent on time rate is payable, while higher price rate on whole output is paid if output exceeds standards. At the same time, it provides security/encouragement to less efficient workers.

3.3.4 Premium Bonus Plans

Under the time rate basis of wage payment, additional production beyond normal level benefits the employers, whereas, with piece rate system the benefit goes to the employees. Bonus plans are a mid-way in the sense that savings are shared between them. The plans included in premium bonus plans are Halsey Premium Plan, Halsey-Weir Plan, Rowan Plan, and Bedaux Point Plan.

3.3.5 Halsey Premium Plan

It is a type of incentive wage plan in which a guaranteed wage is provided in addition to an extra bonus for production in excess of the standard. Under this system, time rate is guaranteed and if a worker completes his jobs within/in more than standard time, he is paid the standard rate. But if the job is completed in less than the standard time, he is given wages for actual hours taken plus bonus equal to normally 50 per cent of the wages of, the time saved; the remaining portion represents the share of the employer. The earning of a worker is computed according to following equation.

Workers earnings = (Time taken x Rate) + [0.50 x (Standard time - Time taken) x Rate]

3.3.6 Halsey-Weir Premium Plan

This plan is similar to the Halsey Plan with the only difference that the bonus/premium is usually applied on 33.33: 66.67 basis.

3.3.7 Rowan Plan

It is a type of incentive wage plan that provides a worker with a standard rate for completing a job within an established time, plus a premium determined on the basis of

the percentage of time saved.
This scheme is similar to the Halsey Plan in that a standard time is fixed for the completion bf a job and bonus is paid in respect of the time saved. But a ceiling is applied to the size of the bonus. The bonus hours are computed as a proportion of the time taken, while time saved bears to the time allowed and is paid for at time rate.

The bonus. = (Time taken ÷ Time allowed) x Time saved x Time rate

The earnings are calculated according to following Equation.

Earnings (Time taken x Rate per hour) + [(Standard time - Time taken) ÷ Standard time] X Time taken x Rate per hour

3.3.8 Bedaux Point Plan

An incentive wage system first introduced in 1911 for determining earnings in terms of the number of 'man minutes' required to perform a specified job or operation based on a predetermined measured standard. Under this plan, a guaranteed hourly rate is paid until standard production is achieved, and a premium or additional wage is paid for units in excess of standard. Instead of being paid as piece rate, an hour's production is converted into points by dividing a standard hour's production in units into 60 minutes. A minute of standard time is termed as Bedaux Point (B), 60 units making one hour's work and the number of B points determined accordingly for each job.

3.4 Labour Turnover

It is the rate at which employees leave employment at a factory. Labour turnover has important implications for labour cost, efficiency and productivity. The objective should be to keep labour turnover at minimal.

Measurement of Labour Turnover

There are three methods to measure labour turnover: (i) Separation method, (ii) Flux/Separation-cum replacement method, and (iii) Replacement/Net labour turnover method.

3.4.1 Separation Method

Labour turnover is measured according to following equation.
Labour turnover = [(Employees leaving (number of separations) in a period ÷ Average number of workers employed)] x 100

3.4.2 Flux or Separation-Cum-Replacement Method

Labour turnover is measured according to following equation:
Labour turnover = [(Number of separations (employees leaving) + Number of replacements (new employees)] ÷ (Average number employed) x 100

3.4.3 Replacement/Net Labour Turnover Method

Labour turnover is computed according to following equation.
Labour turnover = (Number of workers replaced in a period ÷ Average number employed) x 100

3.4.4 Causes of Labour Turnover

The causes of labour turnover may be avoidable and unavoidable.

Avoidable Causes Such causes are avoidable in the sense that with suitable measures they can be eliminated. They include:

- Low wage rates and earnings
- Dissatisfaction with job/Unsatisfactory working conditions
- Unsatisfactory relationship with supervisors/fellow workers
- Lack of conveyance, accommodations, medical, educational, recreational and housing facilities
- Unfair methods of promotion/lack of promotional avenues
- Seasonal nature of job.

Unavoidable Causes They include

- Change for better jobs
- Retirement and death
- Domestic/family responsibilities/constraints
- Dismissal/discharge due to insubordination, negligence, inefficiency and
- Retrenchment/lay off.

3.5 Exercise

1. Explain the Rowan plan for wage incentives?
2. Explain Halsay plan for wage incentives?
3. What is labour turnover and what are the reasons for labour turnover?

3.6 Practical:

1. The extracts from the payroll of Messrs Shah Bros, is as follows:

Number of employees at the beginning of 1978	150
Number of employees at the end of 1978	200
Number of employees resigned	20
Number of employees discharged	5
Number of employees replaced due to resignations and discharges	20

Calculate the labour turnover rate for the factory by different methods.

Solution : Separation Method = $\frac{\text{Number of Separations}}{\text{Av. No. of Workers}} \times 100$

$= (25/175) \times 100$

$= 14.3\%$

Replacement Method = $\frac{\text{No. of Replacements}}{\text{Av. No. of Workers}} \times 100$

$= (20/175) \times 199$

$= 11.4\%$

Flux Rate (i) = $\frac{\text{No. of Separations + No. of Replacements}}{\text{Av. No. of Workers}} \times 100$

$= (25 + 20) \times 100$

$= 25.7\%$

OR

(ii) = $\frac{\text{(No. of Separations + No. of Replacements)/2}}{\text{Average No of Workers}} \times 100$

$= (((25+20)/2) /175) \times 100$

$= 12.8\%$

For the purpose of comparison, the same method of finding out labour turnover rate should be followed year after year.

2. Calculate the wages for Shri Ram Ltd. due under the Rowan Plan with the following details :

Standard Time	9 hours
Time Taken	6 hours
Normal Rate	0.75 rupee per hour.

Overheads recovered 150% of the direct wages.

Solution : Computation of Wages under Rowan Plan

Standard Time	9 hours
Time taken	6 hours
Time saved	3 hours
Hourly rate	Re. 0.75 per hour

$$\text{Bonus} = \frac{\text{Time saved}}{\text{Standard time}} \times \text{Time Taken X Hourly Rate}$$

$= (3/9) \times 6 \times 0.75$

$=$ Rs. 1.50

Total Earnings = Time taken × Hourly rate + Bonus

$= 6 \times 0.75 + 1.50$

$=$ Rs. 6.00

3. During first week of April, 1977 the workman Mr. Rajdip manufactured 300 articles. He receives wage for a guaranteed 48 hours week at the rate of Rs. 4 per hour. The estimated time to produce one article is 10 minutes and under incentive scheme the time allowed is increased by 20%: Calculate his gross wages according to :

(a) Piece work with a guaranteed weekly wage,

(b) Rowan premium bonus, and

(c) Halsey premium bonus: 50% to workman.

Solution : Gross Wages due to Mr. Rajdip

	Rs.	Rs.
(a) Piece-work with a guaranteed weekly wage		
Wages for 60 hours, *i.e.*, standard time @ Rs. 4 per hour (being more than the guaranteed wage of Rs. 192 for 48 hours)	240.00	
Rate per hour worked : Rs. 240÷48	5.00	
(b) Rowan Premium Bonus Plan		
Wages for 48 hours @ Rs. 4 per hour	192.00	
Bonus : Wages for time worked × Time saved / Standard time		
= Rs. 192 × (12/60)	38.40	130.40
Rate per hour worked : Rs. 230 40÷48	4.80	
(c) Halsey Premium Bonus Plan		
Wages, for 48 hours	192.00	
Bonus : 50% of the wages for time saved	24.00	216.00
Rate per hour worked Rs. 216÷48	4.50	

Working Notes :

Standard time for producing 300 articles :

Estimated time for one article	10 minutes
Add: 20% increase under incentives scheme	2 minutes
Total for one article	12 minutes
Total for 300 articles	3,600 minutes or 60 hours
Time taken	48 hours
Time saved	12 hours

4. A worker takes 9 hours to complete a job on daily wages and 6 hours on a scheme of payment by results. His day rate is 75 paise per hour, the material cost of the product is Rs. 4 and the overheads are recovered at 150% of the total direct wages. Calculate the factory cost of the product under:

(a) Piece Work Plan.

(b) Rowan Plan.

(c) Halsey Plan.

Solution : Calculation of Wages Payable

(a) Under Piece Work Plan

For 9* hours @ Re. 0.75=Rs. 6.75

Since he does work of 9 hours in 6 hours. He is to be paid for 9 hours.

(b) Under Rowan Plan

Time taken × Hourly rate+ (Time Taken / Standard time) × time saved x Hourly rate

= 6 hours × 0.75 + (6/9) × 3 × 0.75 =

= Rs. 4.50 + Rs. 1.50

=Rs. 6

(c) Under Halsey Plan

Time taken × Hourly rate + 50% of time saved × Hourly rate

= 6 hours × 0.75+50% of 3 hours × 0.75

= Rs. 4.50 +1.12

= Rs.5.62.

Statement of Factory Cost

	(a) Rs.	(6) Rs.	0?) Rs.
Material	4.00	4.00	4.00
Direct wages	6.75	6.00	5.62
Prime Cost	10.75	10.00	9.62
Add : Factory overheads @. 150% of wages	10.125	9.00	8.43
Factory Cost	20.875	19.00	18.05

4. Production sections of Nikita Ltd. working on a job-order system pay their workers under the Rowan Premium Bonus Scheme. Workers are also entitled to a dearness allowance of Rs. 24 per week of 48 hours. '. A' worker's basic wage is *Rs. 4* per day of S hours and his tim-2 sheet for a week is summarized below:

Job No.	*time allowed*	*Time taken*
1	25 hours	20 hours
2	30 hours	20 hours
Idle time (wailing.)		8 hours

Calculate the gross wages he has earned for the week.

Solution : Calculation of Gross Earnings for the Week,

	Rs.
Basic Wages:	
For 48 hours @ Rs. 4 per day of 8 hours	24.00
Dearness Allowance	
Per week of 48 hours	24.00
Bonus	
For Job No. 1	
$\frac{\text{Time taken}}{\text{Standard time}} \times \text{Time saved} \times \text{Hourly rate}$	
(20/25) × 5 × 0.50	2.00
For Job No. 2.	
(20/30) × 10 × 0.50	3.33
Gross Wages	53.33

6. In a unit, 10 men work as a group: When the production o the group exceeds the standards output of 200 pieces per hour each man is paid an incentive for the excess production in addition to his wages at hourly rates. The incentives is at half the percentage, the excess production over standards bears to the standards production. Each man is paid an incentives at the rate of this percentage of a wage rate of Rs. 2 per hour. There is no relation between the individual workman's hourly rate and the bonus rate.

In a week,-the hours worked are 500 and total production is 1,20,000 pieces.

(a) Compute the total amount of bonus for the week.

(b) Calculate the total earnings of two workers *A* and *B* of the group:

A worked 44 hours and his basic rate per hours was Rs. 2.20.

B worked 48 hours and his basic Vate per hours was Rs. 1 90.

Solution

(a) Computation o£ bonus

Actual production during the week	1,20,000 pieces
Standard production during the week (200 pieces per hour)	1,00,000 pieces
Production in excess of the standard	20.000 pieces

Excess production percentage,

(20,000/1,00,000) × 100 = 20%

Incentive =1/2 × 20% = 10%

Bonus rate=10% of Rs. 2 = Re. 0.20 per hour.

Total amount of bonus for the week=500 hrs. @ 0.20 per hour = Rs. 100.

(b) Total earnings of workers *A* and B of the group for the week.

Workers *A* :

	Rs.
44 hours @ 2.20 hours	96.80
Bonus 44 hours @ 0.20 per hours	8.80
	Rs. 105-60

Workers - B:

48 hours @ 2.20 per hour	91.20
Bonus for 48 hours @ 0.20 per hour	9.60
	Rs. 100.80

3.7 Exercise:

1. From the following particulars calculate the Group Bonus payable in this case and amounts that will be paid to each member of the group for Unvish Ltd.

Standard production in a week 120 units.

It is agreed that for every 10% increase in production bonus of 5% of the total wages payable of the week will be paid and the same will be shared, by the group consisting of 4 members in proportion or their total wages of the week.

Total production for the week 145 units.

Wages earned by the four member of the group *(ABC* and *D)* are respectively Rs. 80, Rs. 78, Rs. 72 and Rs. 68.

2. There were 980 workers in a Yash Ltd. on 1st of April 2000. During the month 60 workers left the factory and some workers were appointed. On 30th April, the number of workers on payroll was 1020. Compute labour turnover rate by separation method. Also, find out the equivalent annual turnover rate for Yash Ltd.

3. The average number of workers in Charmy Ltd. during a month was3,600. During this month 144 workers left the factory and 180 new workers were appointed. Of the 120 newly employed workers, 144 workers were taken to fill up new posts, while the remaining workers were taken to fill up the vacancies. Compute the labour turnover rate with the help of replacement method and joint method. What will be the annual equivalent turnover r*ate according to both these methods?

4. The personnel department of a company gives up the following information regarding labour. Calculate labour turnover rate by using *(a)* Separation method, *(b)* Replacement method, and *(c)* flux method.

No. of workers on the payroll: At the beginning of the month 900

At the end of the month . 1,100

During the month, 10 workers quit while 40 persons are discharged; 150 workers are recruited during the month. of these, 25 workers are recruited in the vacancies of those leaving, while the rest were engaged for an expansion scheme.

5. Mr. *A* is working by employing 10 skilled workers. He is considering the introduction of some incentive scheme - either Halsey Scheme (with 50% bonus) or Rowan Scheme of wage payment for increasing the labour productivity to cope with the increased demand for the product by 25%. He feels that if the proposed incentive scheme could bring about an average 20% increase over the present earnings of the workers, it could act as sufficient incentive for them to produce more and he has accordingly given this assurance to the workers.

As a result of this assurance, the increase in productivity has been observed as revealed by the following figures for the current month :

Hourly rate of wages (guaranteed) Rs. 2.00

Average time for producing 1 piece by one worker at the

previous performance	2 hours
(This may be taken as time allowed)	
No. of working days in the month	25
No. of Working hours per day for each worker	8
Actual production during the month	1,250 units

6. : 1. Calculate effective rate of earnings per hour under Halsey Scheme and Rowan Scheme.

2. Calculate the savings to Mr. A in terms of direct labour cost per piece under the above schemes.

3. Advise Mr. A about the selection of the scheme to fulfil his assurance.

7. (i) What is meant by the term 'Labour Turnover' ? What is the effect of labour turnover on cost of production ?

(ii) From the following data given by the Personnel Department calculate the labour turnover rate by applying.

(a) Separation Method

(b) Replacement Method

(c) Flux Method

No. of workers on the payroll :

At the beginning of the month	900
At the end of the month	1000

During the month 10 workers left, 40 persons were discharged and 150 workers were recruited. Of these, 25 workers are recruited in the vacancies of these leaving, while the rest were engaged

Unit : 4 : Overhead

Introduction:

Mainly, we can classify the cost in two parts, direct cost and indirect cost direct cost are the costs which are directly related with the product where as the indirect cost are such cost which are indirectly related with the project. Overheads are the examples of indirect cost, such cost we cannot find in the appearance of the cost but this cost is as necessary as any other direct cost. During this chapter, we will discuss about the different aspects of direct cost.

Structure of the chapter:

4.1 Objectives:

- What is meant by overheads
- Different basis for overhead allocation
- Absorption of overheads and its accounting

By the end of this chapter, the student will learn about

4.2 Meaning

Overhead is defined as *'the aggregate of indirect materials cost, indirect wages and indirect expenses'* The word "Indirect" is "that which cannot be allocated, but which can be apportioned to, or absorbed by cost centres or cost units." All expenses over the above the prime cost are known as Overhead charges.

Factory overhead costs refer to all indirect manufacturing costs which cannot be identified with particular orders or units of product. These costs include the following:

- Indirect materials and indirect labour.
- Factory rent, rates, lighting, power, and fuel.
- Depreciation on factory plant and equipments and factory building.
- Insurance, repairs and maintenance of factory plant and equipments and building

This cost can not be charged directly to the product rather it requireds some sort of base for allocation which is known as factory overhead absorption rate.

4.3 Factory Overhead Application/Absorption Rate

Factory overhead cannot be charged directly to the products, so for charging such cost factory overhead absorption rate is used. Direct costs normally can be conveniently identified/allocated to specific jobs. The same is, however, not true for the indirect manufacturing costs as they are incurred for the factory as a whole. Being *common costs,* they are divided/shared/charged among various *cost centres* and/or *cost units.*

The procedure for allotting factory overheads to cost centres/objects/units cover cost allocation, cost apportionment, and overhead absorption. While the allotment of whole items of cost to cost centres or cost units is referred to as *cost allocation,* the allotment of common costs to two or more cost centres on the estimated basis of benefits received is known as cost *apportionment.* The allotment of factory overheads to cost units/objects by means of predetermined factory overhead application rate is called *overhead absorption.*

The factory overhead absorption rate can either be *actual* overhead rate or a *predetermined* overhead rate. The two key factors to determine the factory overhead application rate for a period are: (a) To select a volume/level of production (more commonly referred to as capacity) to be used as a base for applying factory overheads to production (denominators) and (b) To budget factory overheads at the capacity selected (numerator)?)

Overhead Absorption rates

- Direct wages percentage = (departmental overheads / direct wages)*100
- Units of output = departmental overhead/output
- Direct materials percentage =(department overheads/direct materials)*100

Prime cost percentage.= (department overheads?prime cost)*100

4.4 Cost Allocation

Cost allocation is mainly related with the distributing various overheads to different departments and ultimately to different products with appropriate basis. When a company produces more than one product, it is important that the factory overhead costs (as determined above) are allocated to various production departments or cost centres. These departments, in turn, assign these costs to product(s) on some equitable basis. This process of assigning direct and indirect manufacturing costs to various cost centres is referred to as *cost allocation.*

Allocation is the allotment of whole items of cost to cost units or cost centres, whether they may be production cost centres or service cost centres.

The cost allocation process is comprised of three basic activities.

1. Accumulating the costs on the basis of department or division or product.
2. Identifying the cost objects or recipients of the allocated costs, say, a unit of product or a department.
3. Selecting a method for relating the costs so accumulated to the cost objects.

Expense Allocation Policies:

If an expenditure solely benefits one project, it should be charged entirely to that benefiting project. However, sometimes an expenditure can benefit two or more projects.

While, no allocation base can be hundred per cent foolproof (in terms of precision and accuracy), following bases are commonly used for allotting fixed overheads:

4.4.1 Labour-Related Factory Overheads

(Say supervisor's salaries, canteen expenses) are usually allocated on the basis of number of employees, direct labour-hours, wages paid or similar other labour related criteria.

4.4.2 Machine-Related Factory Overheads

(Say insurance, maintenance, depreciation) are normally allocated on the basis of machine-hours, current book value of machinery, number of machines, or similar other machine-related criteria.

4.4.3 Space-Related Factory Overheads

(Say factory building rent and insurance, lighting, maintenance of building) are usually allocated on the basis of space occupied or similar other space-related criteria.

4.4.4 Service-Related Costs

(Say materials handling, utility) are normally allocated on the basis of value, quantity, time and similar other service related criteria.

4.4.5 Departmental Rates

It is common for manufacturing firms to have several departments that are involved either directly or indirectly in production. The discussion that follows dwells on determination of departmental rates related to factory overheads.

Direct Departmental Costs

These are the costs which are directly applicable to various departments. These are the costs which can be easily traced to specific departments.

Indirect Departmental Costs

These are the costs which are common to more than one department and, hence, need to be shared/apportioned among the departments receiving benefits. E.g. rent, insurance premium.

4.5 Charging Cost Of Service Departments

A service department is a department which provides benefits to producing departments. For instance, maintenance department (responsible for the upkeep of the machinery and building). The cost of service departments are required to be allocated to various production departments and for the purpose various methods are available like,

(i) Direct method, (ii) Step method, (iii) Repeated distribution method, and (iv) Algebraic method.

4.5.1 Direct Method

Total budgeted costs of service departments are apportioned between/among production departments only, ignoring any services provided by service departments to each other. This method is the most appropriate when there is virtually no provision of rendering services on reciprocal basis among the service departments. This method has the virtue of simplicity as far as its use in assigning costs to production departments is concerned.

4.5.2 Step Method.

In situations, when one service department renders services to another (that is reciprocity exists), the step method is more appropriate than the direct method. This method takes into consideration the *-total/true* cost of each service department (and not partial) in assigning them to production departments. The following is a list of steps used for the purpose of apportioning budgeted costs of service departments:

(i) It is usual to apportion first the cost of that service department which renders services to the largest number of other service departments.

(ii) The budgeted costs of the service department that renders services to the next largest number of service departments are then apportioned. Obviously, any apportioned costs added to this service department from step 1 are

included. The sum of budgeted service cost, so arrived at, is then apportioned among the remaining service departments (whose costs are yet to be assigned). The service department whose budgeted costs were apportioned as per the step 1 will not receive any cost share from the second department.

(iii) This sequence is continued, step-by-step, until all the budgeted service department costs have been apportioned to production departments.

4.5.3 Repeated Distribution Method

The process of apportioning service departments overhead is Continued until the figures of unapportioned sum(s) of service department(s) become negligible: The following steps are involved in its application:

(i) The first service department's (to be identified on the basis of the order in which their names are stated) budgeted costs are to be apportioned. As a result, the balance of the first service department "becomes nil; its costs are apportioned among other departments (on the basis Of their percentage share ,or some other base stated).

(ii) The budgeted costs of the second service department (consisting of original amount plus the apportioned sum from the first service department) is to be apportioned among other departments including the first service department.

(iii) This process continues for all the remaining/other service departments. The steps shown as per (i) to (iii) refer to the first.

(iv) The second phase of cycle starts once again with the first service department; it will consist only of apportioned amounts from other service departments. As a result, the total costs of service departments become less and less with each phase of apportionment.

(v) The process comes to an end when it is found that the residual sum (to be apportioned) has been either exhausted or has become virtually insignificant.

4.6 Absorption of Factory Overheads

Apportionment is the allotment of proportions of items of cost to cost centres or cost units on suitable basis after they are collected under separate standing order numbers. It may be the basis of services rendered by a particular item of expense to different departments or by survey method. Sometimes, the basis will be the 'Ability to pay method' i.e. ability of the department to bear such share of items of overheads.

Factory overhead can not be directly charged to the products so it is charged on the basis of some selected basis. It is imperative to have an equitable allotment of factory overheads to cost units. This allotment of factory overheads to cost units/cost objects is referred to as *absorption.*

Some common bases for absorption of factory overhead are: (i) Units of production (ii) Direct materials cost, (iii) Direct labour cost (iv) Prime cost method (v) Direct labour-hours and (vi) Machine-hours.

Underabsorption and Overabsorption of factory Overheads

Factory overheasds are absorbed on the basis of estimations and such estimations may be wrong and due to that the overheads may be absorbed more in amount then actually incurred or vice versa. Once the factory overhead absorption/application rate has been determined, it is used as the basis to charge factory overhead costs to actual production. The rate is applied to production on an ongoing basis as goods are manufactured according to the method used (say, direct labour-hours, machine-hours, units produced).

The under-absorption and overabsorption of factory overheads are computed as per Equations given below.

Under-absorption of factory overheads = Actual factory overheads - Overheads charged to production

Overabsorption of factory overheads = Overheads charged to production - Production overheads

The difference between the actual factory overhead costs and absorbed factory overheads is referred to as overhead variance. Overhead variances may be disposed of by following either of the two methods:

First, they may be treated as a period costs and, therefore, assigned to the income statement of current period. The adjustment is made through cost of goods sold account. Journal entries will be as follows:

Cost of Goods Sold A/c ..... Dr	
To Factory Overhead Control A/c	
(For charging under-absorbed factory overheads)	
Factory Overhead Control A/c.....Dr	
To Cost of Goods Sold A/c	
(For adjusting over-absorbed factory overheads)	

This method is normally used when variance is insignificant in amount.

In the second method, it may be considered as the cost of production of the current period and the amount is pro-rated to work-in-process inventory, finished goods inventory, and cost of goods sold in proportion to the unadjusted factory overhead balance in each account. This method is normally used when the variance is significant in amount. Journal entries would be as follows:

Work-in-process Inventory A/c.....	Dr
Finished Goods Inventory A/c.....	Dr
Cost of Goods Sold A/c.....	Dr
To Factory Overhead Control A/c	
(For charging under-applied factory overheads)	

Factory Overhead Control A/c..... Dr
To Work-in-process Inventory A/c
To Cost of Goods Sold A/c
(For adjusting over-applied factory overheads)

4.7 Practical:

1. Vanita Ltd. have three production\ departments *(A, B* and *C)* and two Service Departments *(D* and *E).* From the following figures extracted from the records of the company, calculate the overhead rate per labour hour:

Indirect materials	Rs. 15,000
Indirect wages	10,000
Depreciation on machinery	25,000
Depreciation on buildings	5,000
Rent, rates and taxes	10,000
Electric power for machinery	15,000
Electric power for lighting	500
General expenses	15,000
Total	95,500

Items	*Total*	*A*	*B*	*C*	*D*	*E*
Direct materials	60,000	20,000	10,000	19,000	6,000	5,000
Direct wages	40,000	15,000	15,000	4,000	2,000	4,000
Value of machinery	2,50,000	60,000	1,00,000	40,000	25,000	25,000
Floor area (sq. ft) .	50,000	15,000	10,000	10,000	5,000	10,000
Horse power of Machines	150	50	60	30	5	5
No. of light points	50	15	10	10	5	10
Labour hours	15,000	5,000	5,000	2,000	1,000	2,000

The expenses of Service Department *D* and £ are to be apportioned as follows.:

	A	*B*	*C*	*D*	*E*
D	40	20	30	—	10
E	30	30	40	—	—

Solution : Computation of Departmental Overhead Rates

	Basis of P, Charge —	*reduction Departments*			*Service Departments*		*Total*
		A	*B*	*C*	*D*	*E*	
Direct Materials	Allocation	—	—	—	6,000	5,000	11,000
Direct Wages	Allocation	—	—	—	2,000	4,000	6,000
Indirect. Materials	Direct Materials	5,000	2,500	4,750	1,500	1,250	15,000
Indirect Wages	Direct Wages	3,750	3,750	1,000	500	1,000	10,000
Depreciation :	Value of						
Machinery	Machinery	6,000	10,000	4,000	2,500	2,500	25,000
Building	Floor area	1,500	1,000	1,000	500	1,000	5,000
Rent, Rates & Taxes	Floor area	3,000	2,000	2,000	1,000	2,000	10,000
Electricity ;							
Machinery	H.P.	5,000	6,000	3,000	500	500	15,000
Lighting	Light points	150	100	100	50	100	500
General Expenses	Labour hours	5,000	5,000	2,000	1,000	2,000	15,000
		29,400	30,350	17,850	15,550	19,350	1,12,500
Cost of Service Deptt. D apportioned		6,220	3,110	4,665	15,550	1,555.	—
		35,620	33,460	22,515	—	20,905	1,12,500
Cost of Service Deptt. *E* apportioned		6,272	6,271	8,362	—	20,905	—
Total overheads		41,892	39,731	30,877	—	—	1,12,500
Labour hrs.		5,000	5,000	2,000	—	—	—
Overhead Rate per direct labour hour		8-38	7.95	15.44			

Note: The direct material and direct labour costs for Service Deptts. *D & E* are indirect costs for the Prod. Deptts. *A, B & C* for which Overhead Rates are to be computed.

2. From the budgeted figures of Chirag Ltd. Soap Factory

(a). Prepare Normal Overhead Application Rates using

(i) Direct Labour Rate Method.

(ii) Direct Labour Cost Method.

(iii) Machine-hour, Rate Method.

Budgeted figures for the year :

Estimated factory overheads		**Rs 58,000**
Estimated direct labour hours	1,34,609	
Estimated direct labour cost	Rs 97,800	
Estimated machine-hours		**50,500**

(b) Prepare a comparative statement of cost showing the result of the application of each of the above rates to Batch No. 243 from the data given below :

Direct materials consumed		Rs. 42
Direct labour		Rs. 45
Direct labour hours		30
Machines hours		20

Solution : *(a)* Computation of Normal Overhead Application Rates

1	Direct Labour Method	
	Estimated factory overheads	58,000
	Estimated direct labour hours	1,34,600
	Overhead application rate (per direct labour hour)	=(58,000/1,34,600) = Rs. 431
2.	Direct Labour Cost Method	
	Estimated factory overhead	58,000
	Direct labour cost	97,800
	Overhead application rate (as a percentage to direct labour)	=(58,000/97,800) × 100 = 59.30%
3.	Machines-hour Rate Method	
	Estimated factory overheads	58,000
	Estimated machine hours	50,500
	Overhead application rate (per machine hour)	(58,000/50,500) = Rs. 1.149

(b) Comparative Statement of Cost of Batch No 243

	Direct Labour Rate Method	*Direct Labour Cost Method*	*Machine Hour Rate Method*
Direct Material consumed	42	42	42
Direct Labour	45	45	45
Prime Cost	87	87	87
Factory Overhead	12.93	26.68	22.98
Cost	99.93	113.68	109.98

3. The following expenses were incurred annually in Ashish Ltd. having S machines of similar nature :

(i)	Lighting for the factory Rs.	800
(ii)	Supervision Rs	900
(iii)	Repairs Rs.	2,400
(iv)	Rent and Rates Rs.	4,000
(v)	Attendants : Two persons looking after eight machines paid @ Rs. 60 per month each	
(vi)	Interest paid on loan Rs.	2,000
(vii)	Power consumed for the shop at 10 paise per unit Rs.	9,600
(viii)	Depreciation per machine Rs.	300
(ix)	Sundry supplies for factory Rs.	240
(x)	Each machine consumes 10 units of power in an hour	

Calculate Machine Hour Rate if a machine runs for 1,200 hours in a year.

Solution: Computation of Machine Hour Rate		
		Per Hour
Standing Charges		
Lighting	800	
Supervision	900	
Rent and Rates	4,000	
Attendants' wages	1,440	
Sundry supplies	240	
Total Standing charges	7,380	
Standing Charges per hour =	7.328 / (8 ×1200)	77
Machine Expenses		
Repairs 2400 / (8 × 1,200)		0.25
Pwer 9,600 / (8 × 1,200)		1.00
Depreciation 300/ 1200		0.25
Machine Hour Rate		2.27

Note : Interest on loan is a financial matter and hence ignored.

4. Calculate Machine Hour Rate of *A* Machine :

Consumable stores	Rs. 600 for *A* Machine
Consumable stores	1,000 for *B* Machine
Repairs	800 for *A* Machine
Repairs	1,200 for *B* Machine
Heat and light	360
Rent	1,200
Insurance of building	4,800
Insurance of machines	800
Depreciation of machines	700
Room service	60
General charge	90

Additional information :

	Working Hours	*Area (sq.ft.)*	*Book Value (Rs)*
A Machine	10,000	100	12,000
B Machine	25,000	500	20,000

Solution: Computation of Machine Hour Rate for Machine A

		Per hour Re.
Standing Charges.		
Consumble Stores	600	
Heat & Light (360 ×100/600)	60	
Rent (1,200 ×100/600)	200	
Insurance of Buildings, (4,800 × 100/600)	800	
Insurance of Machines (800 × 12,000/32,000)	300	
Room Service (60 × 100/600)	10	
General Charge (90 × 100/600	15	
Total Standing Charges	1,985	
Standing Charges per hour (1,985/10,000)		0.199
Machine Expenses		
Repairs (800/10,000)		0.080
Depreciation of Machines (135.48/10,000)		0.014
Machine Hour Rate		0.293

Working Notes :

(i) Heat and light, rent, insurance of buildings, room service and general charges have been apportioned over machines *A* and *B* in the ratio of floor area.

(ii) Insurance of machines has been apportioned over Machines *A* and *B* in the ratio of their respective values.

(iii) Depreciation of Machines has been apportioned in weighted ratio ; Working hours × Value of machinery, calculated as given below:

Machined: 10,000 × 12,000 Machine *B* :25,000 × 20,000

or =120: 500

= 6: 25

For Machine 4 Depreciation comes to : 700 × 6/31=135.48.

5. Compute the machine-hour rate from the following data for Surplus Ltd.:

Cost of machine	Rs. 1,00,000
Installation charges	10,000
Estimated scrap value after the expiry of its life (15 years)	5,000
Rent and rates for the shop per month	200
General lighting for the shop per month	300
Insurance premium, for the machine per annum	960
Repairs and maintenance expenses per annum	1,000
Power consumption — 10 units per hour	—
Rate of power per 100 units	20
Estimated working hours per annum— 2,200.	
This includes setting-up time of 200 hours	—
Shop supervisor's salary per month	600

The machine occupies 1/4 of the total area of the shop. The supervisor is expected to devote 1/5 of his time for supervising the machine.

Solution : Computation of Machine hour Rate

	Rs.	Rs.
Standing Charges :		
Rent and rates (200 × 1 2) × 1 /4	600	
General lighting (300 × 12)' × 1/4	900	
Insurance premium	960	
Shop supervisor's salary (600 × 12) × 1/5	1,440	
	3,900	
Hourly rate for standing charges (Rs. 3,900/2,000 hrs.)		1.95
Machine Expenses :		
Depreciation (Rs. 1,10,000— Rs. 5,000) / 30,000 hrs.		3.50
Repairs and maintenance (1,000/2,000)		0.50
Power — 10 units per hour @ Rs. 0.20 per unit		200
Machine -hour rate		7.95

Note : Setting-up time has been presumed as non-productive time and hence productive time is only 2,000 hours.

6. The following information is obtained from the costing records of Sun Ltd.:

Actual total overheads	Rs. 3,75,000
Actual hours worked	2,50,000
Budgeted Rate of recovery of overheads is Re. 1 per hour	
Units produced	9,800
Units sold	9,000
Units in work-in-progress	200

On verification it was found that 25% of the unabsorbed overheads was due to increase in cost of indirect material and indirect labour and 75% was due to inefficiency in the factory. Show the effects on cost of units produced.

Solution

Actual overheads recovered 2,50,000 × Re. 1	Rs. 2,50,008
Actual overheads incurred	3,75,009
Under-recovery	Rs. 1,25,000

25% of unrecovered overheads is due to increase in the cost of indirect material and indirect labour.So 25% of Rs. 1,25,000, *i e.,* Rs. 31,25.0 be recovered by a supplementary rate.

Units produced including work-in progress are 9,800+200 (presuming work-in-progress is in terms of equivalent complete units) *i.e.,* 10,000

Supplementary rate = 31,250 / 10,000

=Rs. 3.125 per unit

The amount Rs. 31,250 should be apportioned as follows :

Cost of sales 9,000×Rs. 3.125=Rs. 28,125

Finished goods 800×Rs. 3.125= 2,500

Work-in-progress 200×Rs. 3.125 = 625

Total Rs. 31,250

The balance 75% of Rs. 1,25,000, *i.e.,* Rs. 93,750 was due to inefficiency of the factory. It should, therefore, be charged to costing profit and loss account.

7. Sandip Industries absorbs factory overhead costs at Rs. 2.50 per direct labour hour. Both opening and closing balances of work-in progress and finished goods inventories are zero.

The following data are available for the year 1982 and the fact that all goods produced have been sold :

Direct labour hours used	50,000
Direct labour cost	Rs. 1,00,000
Indirect labour cost	25,000
Indirect materials cost	10,000
Depreciation of plant and equipment	50,000
Miscellaneous factory overheads	50,000

Assuming that all goods produced have been sold—

(i) calculate factory overheads incurred and factory overheads absorbed ; and

(ii) pass a journal entry for disposing of over-absorbed or under-absorbed factory overheads.

Solution :

Budgeted factory overhead rate Rs. 2.50 per hour

(i) Factory overheads incurred :

Indirect labour	Rs. 25,000
Indirect materials	10,000
Plant Depreciation	50,000
Miscellaneous factory overheads	50,000
	Rs. 1,35,000

Factory Overheads Absorbed

Rs. 2.50 × 50,000 hours = Rs. 1,75,000

Underabsorbed Factory Overheads (Rs. 1,15,000— Rs. 1,25,000)

= Rs. 10,000

Supplemental y Overhead Rate (positive).

= (Rs. 10,000 / 50,000 hrs)

= re. 0.20 per labour hour

(ii)The journal entry would be as under—

Cost of Sales	Dr.	10,000
To Factory Overheads Control A/c.		10,000

8. The budgeted working conditions for a Cost Centre of Sachin Ltd. are as follows :

Normal working per week	42 hours
Number of machines	14
Normal weekly loss of hours on maintenance etc.	5 hours per machine
Number of weeks worked per year	48
Estimated Annual Overheads	Rs. 1,24,320
Estimated direct wage rate	Rs. 4 per unit

Actual result in respect of a 4 week period are :

Wages incurred	Rs. 9,000
Overheads incurred	Rs. 10,200
Machine Hours produced	2,000

You are required to calculate :

(a) the Overhead Rate per machine hour ; and

(b) the amount of under-or-over absorption of wages and overheads.

Solution

(a)	Normal Working Hours per year	14 ×42×48=28,224 hours
	Normal Loss of hours per year due to maintenance	14 × 5×48= 3,360 hours
	Effective Hours per year	=28,224-3,360
		=24,864 hours
	Estimated Annual Overhead	=Rs. 1,24,320
(b)	Overhead absorbed 2,000 hrs × Rs. 5	= Rs. 10,000
	Overheads incurred	=Rs. 10,200
	(i) Overhead Under-absorbed	=Rs. 200
	No. of hours for a 4 week period @ 42 hours per week per machine	= 42 × 4= 168 hours
	For 14 machines	= 168 ×14 = 2,352 hours
	Wages absorbed for 2,352 hours @ Rs. 400	= Rs. 9,408
	Wages actually incurred	=Rs. 9,000
	(ii) Wages Over-absorbed	=Rs. 408

9. The "total overhead expenses of Amitabh Ltd. are Rs. 8,23,800 during 2000. Taking into account the normal working of the factory, overhead was recovered in production at Rs. 2.50 per hour. The actual-hours worked, were 2,90,000 during 2000. How would you proceed to close the books of account, assuming that besides 12,500 units were produced of which 11,000 were sold, there were 500 units in work-in-progress?

On investigation it was found that 50 percent of the unabsorbed overhead was on account of increase in the cost of indirect materials and indirect labour and the other 50 percent was due to factory inefficiency.
How will you treat under-absorption amount in Cost Accounts? Give also the profit implication of this method.

Solution

	Rs.	
Overhead Recovered (2,90,000 hours × 2.50)		= 7,25,000
Actual Overhead incurred		= 8,23,800
Under Recovery	98,800	

Of this 50% is due to the increased cost of indirect material and indirect labour, which should be recovered by a supplementary rate.
Total production 12,500 units + 500 W-m-progress = 13,000 units.
50% under recovery = 98,800 × 50% - Rs. 49,400

Rs. 49,400
Supplementary Rate = 13,000 units
= Rs. 3.80

Thus the under absorption of Rs. 49,400 will be charged to the following three items.

		Rs.
(1) Cost of Sales	= 11,000 units × Rs. 3.80	= 41,800
(2) Finished goods	= 1,500 units × Rs. 3.80	= 5,700
(3) W-m-progress	= 500 units × Rs. 3.80	= 1,900
		98,800

With the use of this method, the profit will decrease by Rs. 41,800. because cost of sales has increased by Rs. 41,800. The cost of stock will also increased by Rs. 7,600 (5,700 + 1,900 as in (2) & (3) above), which will have its effect on profit.

The remaining 50% of under-absorption. Rs. 49,400 is due to inefficiency of the factor and therefore, it will be transferred to costing P & L A/c. It. Will not be included in cost.

10. The' Cost 'Accountant of Das Chemicals Ltd. determined the overhead recovery rate for the year 2000, (based on direct labour hours) with the following estimates :

Rs.

Indirect labour	1,15,000
Inspection	70,000
Factory supervision	50,000
Depreciation and maintenance	1,25,000
Total factory overhead	3,60,000
Direct labour hours	75,000
Hourly wage rate	Rs. 15

The actual results for the year are as follows

	Rs.
Indirect labour	99,000
Inspection	73,000
Factory supervision	51,000
Depreciation and maintenance	1,15,000
Total actual factory overhead	3,38,000
Direct labour hours	67,600
Hourly wage fate	Rs. 16

Calculate the pre-determined overhead recovery rate and find out the amount of over/under-absorption if any.

How will you treat the over/under-absorption amount in Cost Accounts?

Solution:

Pre-determined overhead recovery rate direct labour hours	= Estimated overhead/Estimated
	= 3,60,000/75,000
	= Rs. 4.80 per hour
overheads recovered	= 67,600 × Rs. 4.80
	= Rs. 3,24,480
Under-recovery of overheads	= Rs. 3,38,000 - Rs. 3,24,480
	= Rs.13,520
Supplementary rate	= 13,520/67,600 hours
	= Re. 0.20 per hour

The under-recovery of Rs. 13,520 may be charged to production on the basis of supplementary overhead rate amounting to Re. 0.20 per direct labour hour. This will increase the cost of sales, cost of finished stock and cost of work-in-progress.

4.8 Practical Exercise:

1. Late in 1982, Suraj Ltd. set up a factory overhead absorption rate of 84 per cent of direct labour cost based on the following budget:

Factory overhead costs	Rs. 75,600
Direct labours hours	60,000
Labour rate per hour	Rs. 1.50
Direct labour cost	Rs. 90,000

Early in 1983, the method of operations was changed. The new operations require labour that will be paid Rs. 1.75 per hour ; the operating time would be reduced by 20 per cent.

What steps should be taken by the company's cost accountant to meet the situation ? Give, the necessary calculations also.

2. In a manufacturing unit of Swati Ltd., overhead was recovered at a pre-determined rate of Rs. 25 per man-day. The total factory overhead expenses incurred and the man-days actually worked were Rs. 41.50 lakhs and 1.50 lakhs days respectively.

Out of the 40,000 units produced during a period, 30,000 were sold.

On analysing the reasons, it was found that 60% of the unabsorbed overheads were due to defective planning and the rest were attributable to increase in overhead costs.

How would unabsorbed overheads be treated in cost account ?

3. In Master Ltd., overheads of a particular department are recovered on the basis of Rs. 5 per machine hour. The total expenses incurred and the actual machine hours for the department for the month of August were Rs. 80,090 and 10,000 hours, respectively. Of the amount .of Rs. 80,000, Rs. 15,000 became payable due to an award of the Labour Court and Rs. 5,000 was in respect of expenses of the previous year booked in the current month (August). Actual production was 40,000 units, of which 30,000 units were sold. On analysing the reasons, it was found that 60% of the under-absorbed overhead was due to defective planning and the rest was attributed to normal cost increase. How would you treat the under-absorbed overhea'd in the cost accounts ?

4. In Sita Ltd., overhead was recovered at a predetermined; rate of Rs.25 per man-day. The total factory overhead expenses incurred and the mandays actually worked were Rs. 41.50 lakhs and 1.50 lakh days respectively. Out of the 40,000 units produced during a period, 30,000 were sold.

On analysing the reasons, it was found that 60% of the unabsorbed overheads were due to defective planning and the rest were attributable to increase in .overhead costs.

How could unabsorbed overheads be treated in cost accounts?

5. The total overhead expenses of Narayan Ltd. are Rs4,50,608. Taking into account the normal working of the factory, overhead was recovered in production at Rs. 1.25 per hour. The actual hours worked were 2,93,104. How would you proceed to close the books of accounts, assuming that besides 7,800 units produced of which 7,000 were sold, there were 200 equivalent units in work-in-progress? On investigation it was

found that 50 percent of the unabsorbed overhead was on account of increase in the cost of indirect materials and indirect labour and the other 50 percent was due to factory inefficiency. Give also the profit implication of this method.

6. A cost center in Bhargav Ltd. furnishes the following working conditions :

Normal working during a week	40 hours
Number of machines	15
Number of- weekly loss of hours on maintenance etc.	4 hours per machine
Estimated annual overheads	Rs. 1,55,520
Estimated direct wages rate	Rs. 3 per hour
Number of .weeks worked per year	48

Actual results in respect of a 4-week period are :

Overheads incurred	Rs. 15,000
Wages incurred	Rs. 7,000
Machine hours produced	2,200

You are required to (a) calculate the overhead rate per machine hour, and (b) calculate the amount of under - or over-absorption of both wages and overheads.

7. Ashish Ltd. re-apportions the costs incurred by two service cost centres, materials handling and inspection, 10 the three production cost centres of machining, finishing and assembly.

The following are the overhead costs which have-been allocated and apportioned to the five cost centres :

	Rs.
Machining	400
Finishing	200
Assembly	100
Materials handling	100
Inspection	50

Estimates of the benefits received by each cost centre are as follows:

	Machining	*Finishing*	*Assembly*	*Materials handling*	*Inspection*
	%	%	%	%	%
Materials handling	30	25	35	____	10
Inspection	20	30	45	5	—

You are required to :

(a) calculate the charge for overhead to each of the three production cost centres, including the amounts re-apportioned from the two service centres, using :

(i) the continuous allotment (or repeated distribution) method, and *(ii)* an algebraic method.

8. Dadima Ltd. have three departments which are regarded as production departments.

Service departments' costs are distributed to these production departments using the "Step Ladder Method" of distribution. Estimates of factory overhead costs to be incurred by each department in the forthcoming year are as follows. Data required for distribution is also shown against each department :

Department	*Factory Over-head (Rs.)*	*Direct Labour Hours*	*No. of Employees*	*Area in sq. mt.*
Production				
X	1,93,000	4,000	100	3,000
Y	64,000	3,000	125	1,500
Z	83,000	4,000	85	1,500
Service :				
P	45,000	1,000	10	500
Q	75,000	5,000	50	1,500
R	1,05,000	6,000	40	1,000
S	30,000	3,000	5.0	1,000

The overhead costs of the four service departments are distributed in the same order, *viz., P, Q, R* and *S* respectively on the following basis :

Department		*Basis*
P	—	Number of Employees
Q	—	Direct Labour Hours
R	—	Area in square metres
S	—	Direct Labour Hours

You are required to :

(a) prepare a schedule showing the distribution of overhead costs of the four service departments to the three production departments ; and

(b) calculate the overhead recovery rate per direct labour hour for each of the three production departments.

9. A machine was purchased by Rushabh Ltd. on January 1, 1990, for Rs. 5 lakhs. The total cost of all machinery inclusive of the new machine was Rs. 75 lakhs. The following further particulars are available:

Expected life of the machine 10 years.

Scrap value at the end of ten years Rs. 5,000.

Repairs and maintenance for the machine during the year Rs. 2,000. Expected number of working hours of the machine per year, 4,000 hours. Insurance premium annually for all the machines Rs. 4,500.

Electricity consumption for the machine per hour (@ 75 paise per unit) 25 units.

Area occupied by the machine 100 sq. ft.

Area occupied by other machines 1,500 sq. ft.

Rent per month of the department Rs. 800.

Lighting charges for 20 points for the whole department, out of which three points are for the machine Rs. 120 per month.

Compute the machine hour rate for the new machine on the basis of the data given above.

10. The following particulars relate to a new machine purchased by Ajit Ltd.:

	Rs.
Purchase price of the machine	4,00,000
Installation expenses	1,00,000
Rent per quarter	15,000
General lighting for the total area	1,000 per month
Foreman's salary	30,000 per annum
Insurance premium for the machine	3,000 per annum
Estimated repair for the machine	5,000 per annum
Estimated consumable stores	4,000 per annum

Power—2 units per hour at Rs. 50 per 100 units.

The estimated life of the machine is 10 years and the estimated value at the end of the 10th year is Rs. 1 lakh. The machine is expected to run 20,000 hours in its life time. The machine occupies 25% of the total area. The foreman devotes 1/6 of his time for the machine. Calculate the machine hour rate for the machine.

11. Adeshwar Ltd. has three production departments and two service departments. The following figures are extracted from the books of the company

Rent	Rs. 20,000				
Indirect wages	6,000				
Depreciation	40,000				
Lighting	2,400				
Power	6,000				
Others	40,000				
Other particulars :					
	A	*B*	*C*	*D*	*E*
Floor space (sq. ft.)	4,000	5,000	6,000	4,000	1,000
Light points	20	30	40	20	10
Direct wages (Rs.)	9,000	6,000	9,000	9,000	7,000
H.P. of machines	75	30	35	10	-
Value of machinery (Rs.)	1,20,000	1,60,000	2,00,000	10,000	10,000
Working hours	3,113	2,014	2,033		

The expenses of service departments D and E are to be allocated as follows

	A	B	C	D	E
D	20%	30%	40%	-	10%
E	40%	20%	20%	20%	-

12. A Parshwanath Ltd. has two production

departments *X* and *Y* and three service departments: time keeping, stores and maintenance.. The departmental summary showed the following expenses for October 1987 :

Production Departments :		Rs.		Rs.	
X		16,000			
Y		10,000		26,000	
Service Departments :					
Time keeping		4,000			
Stores		5,000			
Maintenance		3,000		12,000	
				38,000	
The other information is :					

Particulars	*Production Dept.*		*Time keeping*	*Stores*	*Maintenance*
	X	*Y*			
No. of employes	40	30	20	16	10
No. of stores requisitions	24	20	-	-	6
Machine hours	2.400	1,600	-	-	-

You arc required to make departmental allocation of expenses.

4.9 Exercise

1. What is meant by overhead?
2. Write a note on basis of allocations for overheads?
3. What is meant by over absorption of overheads and under absorption of overheads and how it can be disposed off in books of accounts?